THE PRAIRIE POT-HOLE LANDSCAPE OF SOUTH HERON LAKE:

OPPORTUNITIES FOR RESTORATION AND DEVELOPMENT

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Produced by the students of Landscape Architecture- 5107, Spring 1990
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INTRODUCTION

The Heron Lake Basin in southwestern Minnesota once supported a teeming population of resident and migratory waterfowl and shorebirds. Today, the Basin's major attractions, North and South Heron Lakes encounter substantial water level fluctuations as a result of rainstorm activity. Water quality in the two lakes has deteriorated dramatically, and lake depths stand at less than half their historic levels. Aquatic vegetation in the lakes has all but disappeared. Waterfowl and shorebird habitat in and around the two lakes has declined precipitously. Area bird populations stand at a fraction of their historic size.

Residents of the Heron Lake Basin have come to realize that many of the lakes' difficulties arise from the way land is managed in the watershed of these lakes. A series of recent studies in the basin have documented the connection of lake quality and watershed management. These studies include the 1982 report by McCombs-Knutson Associates entitled "A Water and Related Land Resources Management Study for the Heron Lake System", the Middle Des Moines Watershed District's 1985 Overall Plan, the recently completed Jackson County Water Resources Plan and the 1989 Heron Lake Restoration Project Report.

In the Fall of 1989, the Heron Lake Area Environmental Association approached Project Future, a community development effort sponsored by the Minnesota Extension Service, about the possibility of engaging students and faculty at the University of Minnesota in land use planning efforts related to improving water quality and waterfowl and shorebird habitat in and around South Heron Lake. Project Future subsequently invited the Department of Landscape Architecture at the University of Minnesota to involve one of its classes in the South Heron Lake project. This report discusses the findings of a study conducted by undergraduate and graduate students in Landscape Architecture as part of a class exercise for LA 5107 - Regional Landscape Design and Planning. The seven week study was conducted during the Spring Quarter of 1990. The primary objectives of the study focused on developing a master plan for South Heron Lake and its watershed that would guide restoration of water quality and waterfowl habitat in and around South Heron Lake and provide a basis for establishing a natural resource oriented sustainable tourism industry.

The faculty and students involved in this project met several times with local and state government officials and concerned citizens in the South Heron Lake area. The students based much of their work on the resource inventory and analyses of the previously cited studies of the Heron Lake Basin. Additional investigations involved use of information supplied by the US Fish and Wildlife Service, the Minnesota Historical Society, the Minnesota Land Management Information center, and the Minnesota Departments of Natural Resources and Transportation respectively.

In the interests of generating multiple sets of ideas that could then be considered and refined by the Heron Lake Area Environmental Association, the class divided the South Heron Lake watershed into three hydrologic units. The first unit included the easterly portion of the watershed that drains directly into South Heron Lake. The second unit encompasses the westerly portion of the South Heron Lake watershed that drains into Elk Creek. The third portion included the middle portion of the watershed that is between the Elk Creek drainage area and the South Heron Lake area. The 14 students in the class then divided themselves into three groups: a group of five students including Fred Rozumalski, Susan Maag, Greg Johnson, Mark Webster and Paul Landwehr who considered the Elk Creek watershed; a group of four student , David Larson, Joella Raynes, David Bachman, and Bart Richardson, who worked with the easterly area around South Heron Lake; and a group of five students including Jon Steffansson, Eric Johnson, Douglas Snyder, Janine Riley and Mark Sauer who considered the middle portion of the Okabena Creek watershed. Each group was assigned two tasks: a) develop and illustrate a watershed management plan for the portion of the basin to which they were assigned; and b) develop and illustrate a tourism resource management plan for the entire South Heron Lake watershed.

The remainder of this report discusses the findings and recommendations of the class effort. A description of the problem facing the entire Heron Lake Basin is followed by a brief discussion of the landscape transformations that have occurred in the watershed since white settlers first ventured into the basin. This introductory material is followed by a discussion of general strategies that need to be pursued to rectify water quality and habitat problems in the Heron Lake watershed. A discussion of how these water quality and habitat improvement strategies relate to the development of a natural resource based tourism industry is followed by presentations of specific recommendations developed by the students.

STATEMENT OF THE PROBLEM

Physical description of Heron Lake Basin

The Heron Lake Basin is located in four southwest Minnesota counties, including Cottonwood, Jackson, Murray and Nobles. The 472 square mile basin contains the sub-basins of North and South Heron Lakes, North Marsh and Duck Lake. The basin's major streams include Okebena Creek which flows into South Heron Lake and Jack Creek, a stream flowing into North Heron Lake. Both Okebena and Jack Creeks flow in an easterly direction, and the Basin's overall east-west dimension exceeds 30 miles. The basin's north-south dimension varies from 10 to 18 miles. Division Creek connects South Heron Lake to North Heron Lake, and flowage from North Heron Lake is northerly toward the Middle Fork of the Des Moines River.

The Heron Lake Basin originally existed as part of a prairie pot-hole complex. A series of shallow lakes, cattail wetlands, wet prairies and mesic prairies evolved in what once had been a large glacial lake basin. North and South Heron Lakes are remnants of this glacial lake. The glacial lake basin in bounded by a stagnation moraine on the east known as the Altamont Moraine and the Bemus moraine, a terminal moraine on the west. The Bemus Moraine follows roughly along Highway 266 northwesterly from Worthington. The Altamont Moraine forming the easterly watershed divide lies between Highways 86 and 17, north of Lakefield. The southerly limits of the Heron Lake Basin extend approximately to I-90 from Worthington on the west to a few miles beyond the Lakefield exit on the east. Soils of the Lake Basin generally consist of glacial till that has a heavier texture on the bed of old glacial lake bottom. Lighter textured soils on both moraines originally supported mesic and dry prairie plant communities.

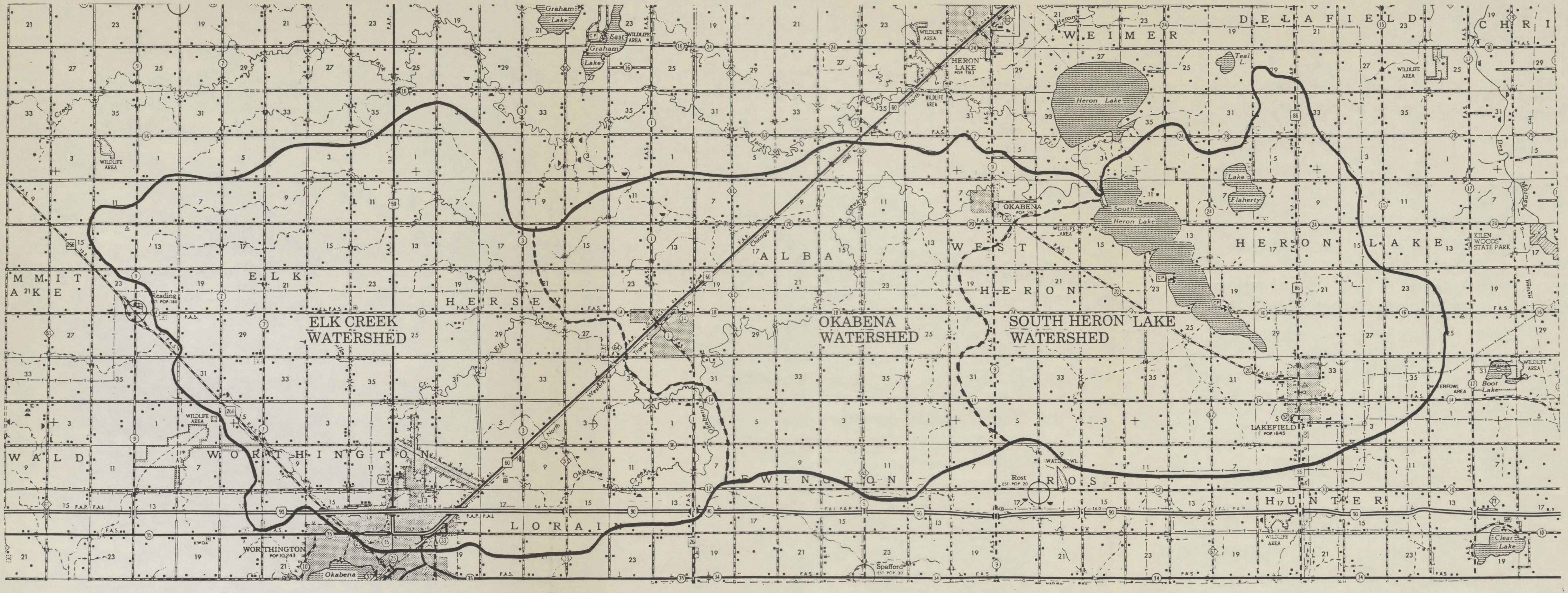
Land use within the basin is predominantly agriculture with over 95% of the basin dedicated to farming. For the most part, the basin's farms are engaged in the production of corn, soybean and beef cattle. The fact that so much of a basin once characterized by wet prairie and wetlands is currently devoted to agriculture is testimony to: a) the inherent fertility of the basin's glacial soils; and b) the advancement of drainage technology. Starting in the early part of the 20th century, the farmers of the basin have constructed a network of drainage ditches to expand the location of arable acreage into areas other than the naturally dry upland sites. After World War II, the drainage ditches were supplemented with an expansive network of drain tiles that pushed drainage further into the wetlands and wet prairies of the glaciated pot-hole complex. Drainage technology has become so ubiquitous that few farms in the basin are unaffected by land drainage.

The drainage system has expanded arable acreage in the basin, but it has also increased the hydraulic efficiency of the watershed. Localized showers producing more than two inches of rainfall anywhere in the basin regularly result in a sudden surge or "bounce" in water level in either North or South Heron Lake by as much as three or four feet over a 48 hour period. Rapid water level fluctuations of this magnitude produce localized flooding adjacent to the two lakes, and they severely affect retention of aquatic vegetation at the lakes' edge.

None of the lakes in this prairie pot-hole complex was ever more than 15 feet deep. Today, depths in South Heron Lake, the Basin's deepest surface water body range up to six feet. Water quality in both North and South Heron Lakes has deteriorated over time. Neither lake now supports the type and abundance of aquatic vegetation (wild celery, cattails, bull rushes, etc.) that existed in the prairie lakes during the pre-settlement period and as recently as the middle part of the twentieth century. As the lakes became shallower, and as water quality deteriorated and aquatic vegetation disappeared,.the lakes were no longer capable of supporting the teeming waterfowl and shoreline populations that once earned Heron Lake a reputation as "the Chesapeake Bay of the North". Similarly, declining lake depths and deteriorating water quality have produced dramatic changes in the fishing resources of the larger lakes in the prairie pot-hole complex. South Heron Lake once supported an ample fishery of Crappie and Northern Pike. Today the lake's predominant species include Carp, Buffalo and Bullhead.

Deterioration of Water Quality and Aquatic Habitat

The deterioration of water quality in the surface water bodies of the Heron Lake Basin, the decline of aquatic vegetation, and the reduction of bird populations associated with the lakes are products of two forms of pollution in the basin. Point-source pollution represents the introduction of contaminants from a single indentifiable origin such as the discharge of waste water from an industry or sewage treatment plant. Non-point sources, on the other hand, are scattered throughout the watershed of a lake or a stream. They are associated with the changes in water quality that occur as surface and subsurface flows of water run over and through the soil. Non-point sources may originate as surface



WATERSHED OF THE HERON LAKE BASIN

BOUNDARIES OF THE WATERSHEDS USED BY STUDENT GROUPS and sub-surface flows dissolve and carry contaminants in solution. They may also arise when flows cause contaminant particles or soil particles to which contaminates are chemically bonded to move from land into surface water bodies. Taken together, these diffused contaminant sources can contribute significantly to the deterioration of water quality in a surface water body.

Major water quality problems plaguing the Heron Lake Basin include sedimentation of soil particles eroded from various sources within the Lake Basin and the over enrichment of the North and South Heron Lakes with nitrogen and phosphorous. Sedimentation of soil particles transported from the drainage basin of North and South Heron Lakes is a consequence of past soil management practices that left soil uncovered for prolonged periods of time. The bare soils were consequently more susceptible to detachment of soil particles by surface water runoff and wind. Detached particles were then carried by the water and wind into adjacent water bodies. The dramatic change in depth that has occurred in South Heron Lake (from as much as 15 feet in 1870's to not more than 6 feet in 1990) is in part a reflection of the magnitude of the sedimentation problem. The sedimentation problem is also revealed by highly turbid water conditions in the two lakes. Water turbidity occurs when surface water contains a large amount of soil particles or algae. High turbidity shades submerged aquatic vegetation, and turbidity caused by suspended soil particles can clog the gills of resident fish populations resulting in their suffocation. When the particles producing high turbidity settle, they can smother fish habitat.

Nutrient enrichment of North and South Heron Lakes is a consequence of both point and non-point sources of pollution in the Heron Lake Basin. However, non-point sources are believed to contribute up to 91% of the nitrogen and up to 69% of the phosphorous entering the two lakes. The overabundance of these two nutrients causes prolific growth of algae in shallow lakes. The expansion of algae populations suspended in the water shades submerged aquatic plants that are rooted in the lake's bottom. Lack of sunlight eventually kills the submerged aquatic plants. Eventually the algae populations also die. Decomposition of the rooted aquatic plants and the algae removes dissolved oxygen from the water to the point where the lake no longer supports aquatic animal life. Low levels of oxygen near the lake's bottom allow additional phosphorous that is chemically bonded to bottom sediment to become water soluble phosphorous, and the cycle of algae growth, decline and decay then repeats itself.

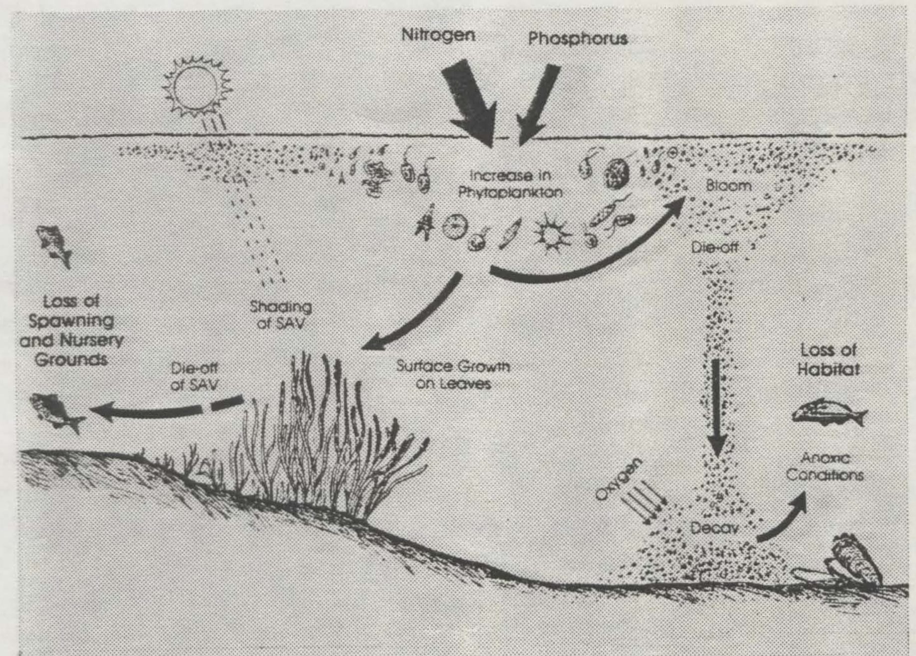


Illustration of Eutrophication
(From *Chesapeake Bay Program: Findings and Recommendations*
EPA Publication, 1983 p.25)

The process of lake decline caused by over enrichment of nitrogen and phosphorous is called eutrophication. All lakes experience some level of eutrophication because surface impoundments tend to act as sinks for nutrients finding their way into surface water. However, shallow lakes are especially susceptible to the problems of nutrient enrichment which result in rapid eutrophication.

Nutrient concentrations as low as 0.10 mg/l of nitrogen and 0.05 mg/l of phosphorous trigger eutrophication. Since phosphorous levels lead to eutrophication at concentrations much lower than is true for nitrogen, eutrophication of aquatic systems is considered a "phosphorous-limited" process. This means that the process proceeds once a minimal level of soluble phosphorous has entered the lake.

Phosphorous generally enters a lake as a phosphate ion that is adsorbed to soil particles. Nitrogen, on the other hand, enters a lake in solution as nitrogen laden runoff flows into the impoundment. Nitrogen also enters the lake as rain and as the atmosphere exchanges gases with the lake's surface. Under normal circumstances, the phosphate-laden sediments sink to the lake bottom and remain chemically bound to the sediment. However, when conditions of low oxygen prevail near the lake bottom, the phosphate is transformed into a soluble form of phosphorous. This transformation then provides the minimal level of phosphorous needed to trigger the eutrophication cycle. In lakes which have been filling with sediment to which phosphate is chemically bound, the lake's bottom can be considered a reservoir of phosphorous which will become water soluble under low oxygen conditions. Eutrophication in these lakes my be considered a nitrogen-limited process.

The reduction of submerged aquatic vegetation that accompanies rapid eutrophication of a lake results in a deterioration of fish and waterfowl habitat. High populations of carp, bullhead and buffalo exacerbate this problem because the breeding and feeding behaviors of these fish result in the uprooting of submerged and emergent aquatic vegetation. Waterfowl and shorebird populations dependent on the aquatic vegetation for nourishment, brood and pairing habitat or nesting must seek new habitat in alternative lake environments. Waterfowl and shorebird habitat is also seriously impaired by the sudden and frequent fluctuations of lake level. Habitat is also eliminated when land is drained or filled to a point where soils no longer support aquatic vegetation.

Resolving Water Quality and Aquatic Habitat Problems

Resolution of point and non-point sources of pollution requires quite different strategies. Point-sources of pollution are addressed by increasing the amount and type of treatment occurring in waste water before it is discharged into surface water bodies. Eliminating or reducing the contribution of non-point sources, on the other hand, requires changing land management practices within the watershed or drainage basin of a surface water body.

Watershed management practices designed to reduce non-point source pollution prevent surface and subsurface flow from coming into contact with contaminants. They retard the movement of contaminants within a watershed, and they also provide a mechanism whereby contaminants can be removed from runoff before surface and subsurface flows reach a surface water body. For example, some soil conservation practice such as residue management (leaving a residue of crop stubble on the soil surface) and permanent cover crops prevent surface runoff from coming into contact with phosphate-laden soil particles. By stabilizing the soil surface, they prevent particle detachment and transportation. Construction of terraces and diversions decrease the speed of runoff movement and thereby reduce erosion potential. Planting alternating strips of row crops and permanent cover crops allows runoff from row-cropped areas to travel through an area where dense cover-crop root systems and stems filter contaminants and slow the rate of runoff movement. Planting cover crops adjacent to wetlands and surface water bodies allows a similar filtering process to occur before runoff becomes part of the surface water system. Wetlands created within a watershed will enable the biochemical processes that occur in standing water to remove nitrogen and phosphorous from surface runoff. Wetlands also enable surface water to infiltrate into the soil where nutrients may then be used to support growth and development of wetland vegetation.

Resolution of the point and non-point sources of sedimentation and nutrient enrichment in Heron Lake Basin will enable surface water bodies such as the North and South Heron Lakes to once again support large populations of waterfowl and shorebirds. Proper management of land use in the watershed will reduce the problems of sedimentation and nutrient enrichment that have produced declining water depths, increased water turbidity and promoted rapid eutrophication in the two lakes. Proper watershed management will also improve waterfowl and shorebird habitat as wetlands are reestablished both immediately adjacent to existing water bodies and within the drainage network of the basin. Finally, proper watershed management will retain more precipitation runoff in the watershed. This will alleviate shoreline problems associated with the three to four foot water level bounce that now occurs in both North and South Heron Lake after rain showers exceeding two inches.

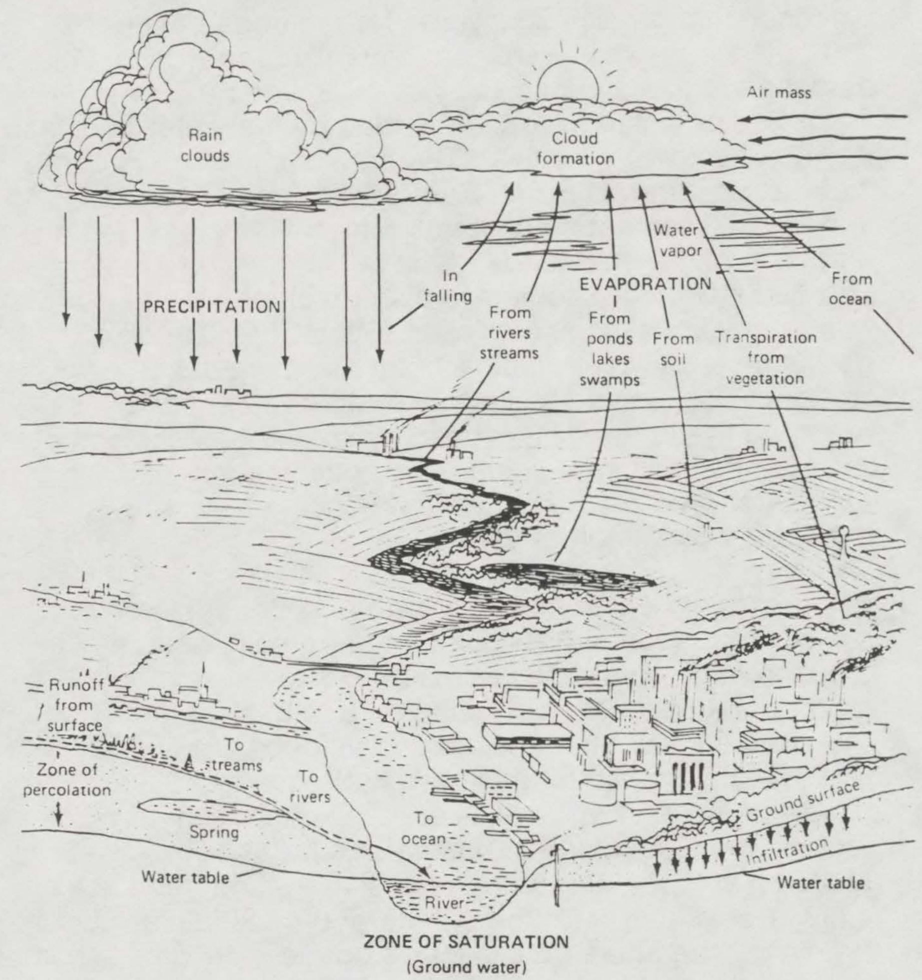


Diagram of the hydrologic cycle within a watershed
(From Ben Osborn and Phoebe Harrison, "Water...and the Land", U.S. Department of Agriculture, Soil Conservation Service, SCS-TP-147 July, 1965)

TRANSFORMATION OF THE HERON LAKE LANDSCAPE

Early Settlement

The landscape of the Heron Lake Basin has experienced radical change during the 100 plus years of white settlement. The glaciated prairie pot-hole complex encountered by the first white settlers contained many shallow lakes, expansive wetlands, and wet prairies in the basin of an ancient glacial lake. This wetland and wet prairie matrix was flanked on the east by the mesic and drier prairies of the Altamont Moraine and on the west by the prairies of the Bemus Moraine. Early settlers in the Heron Lake Basin farmed the upland soils of the moraines leaving alone the pot-hole wetland complex which supported hundreds of thousands of birds during their migratory journeys. By the turn of the century the Heron Lake Basin supported a large commercial bird hunting industry as "market hunters" annually sent thousands of waterfowl to eager consumers in Minneapolis, Chicago and New York. Sportsmen, attracted to the basin from the Twin Cities and Chicago by the diverse and ample bird populations, soon rented land and established gun clubs that ringed North and South Heron Lakes. In this manner the Heron Lake Basin (and especially North Heron Lake) became a club-controlled hunting preserve.

Ditching in the Early 20th Century

Human disturbance began to significantly alter the Heron Lake Basin as turn-of-the-century landowners introduced land drainage technology to the basin. Ditches drained extensive portions of the deep and rich wetland soils in the ancient glacial lake basin near North and South Heron Lakes. The largest of these projects drained the Quevli Slough, south of South Heron Lake. The project's scale pushed the southern limits of the basin's watershed several miles to the south as well as making the fertile soils of the slough arable. Similar drainage projects throughout the Heron Lake basin resulted in the transformation of the ancient glacial lake landscape from wet prairie and wetland into row crops.

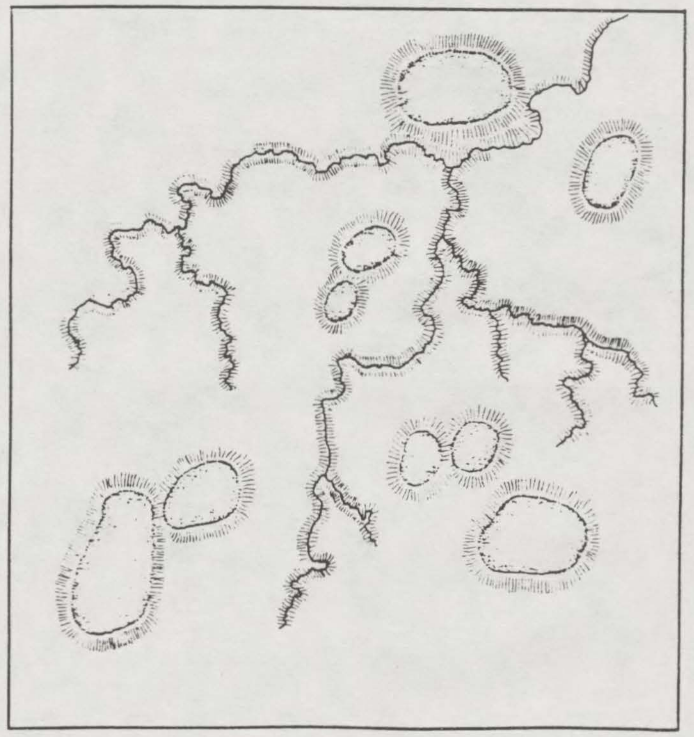
Landscape of Soil Conservation

Extensive soil conservation efforts during the Depression to the 1930's introduced trees and shrubs into the basin's open landscape. Shelterbelts; windrows and fencerows were established to provide relief from the ever-present prairie wind and prevent wind-driven soil erosion. The introduction of trees and shrubs along with other soil conservation practices, such as terracing, contour plowing and the use of permanent cover crops resulted in increased biological diversity. The amorphous glaciated prairie pot-hole complex had been transformed into a geometric agricultural landscape in which Thomas Jefferson's quarter-section lines and quarter-quarter section lines were adorned with trees, shrubs and drainage ditches. The fine textured geometry of agricultural production was broken only by open water bodies and remnant wetlands too extensive to be drained by the ditch network.

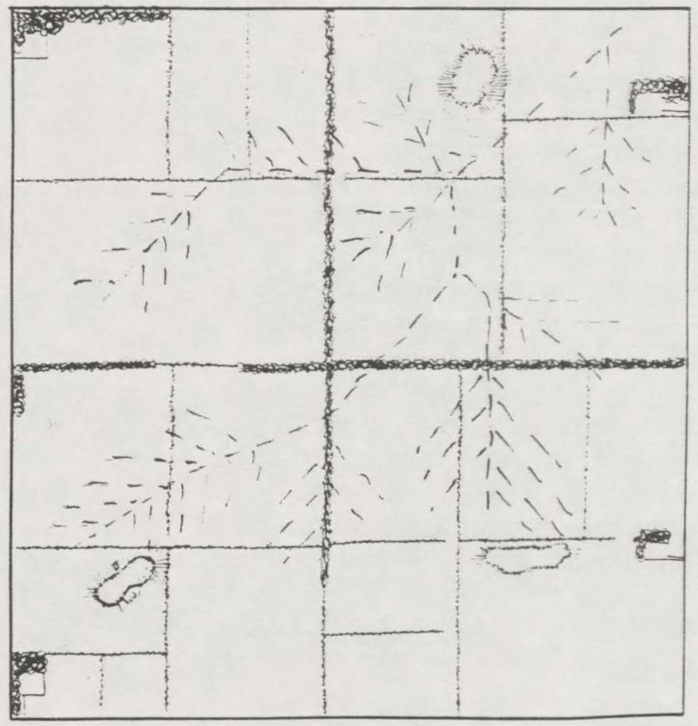
Adoption of Large Scale Monoculture

World War II and the subsequent Marshall Plan for the reconstruction of Europe introduced a third transformation of the Heron Lake landscape. The desire to have Midwestern farmers "feed the world" greatly expanded the demand for agricultural crops. The wide-spread adoption of drainage tiles as fingers of the drainage ditches that could reach farther up into a watershed enabled the draining of nearly all remaining wetlands. Innovations in agricultural technology resulted in dramatic increases in the amount of land that could be worked by one farmer. The larger agricultural machinery that enabled this growth in farm size was not as maneuverable as horse-drawn and early tractor powered equipment. As a result, field size expanded and the tree and shrub plantings of the 1930's were removed.

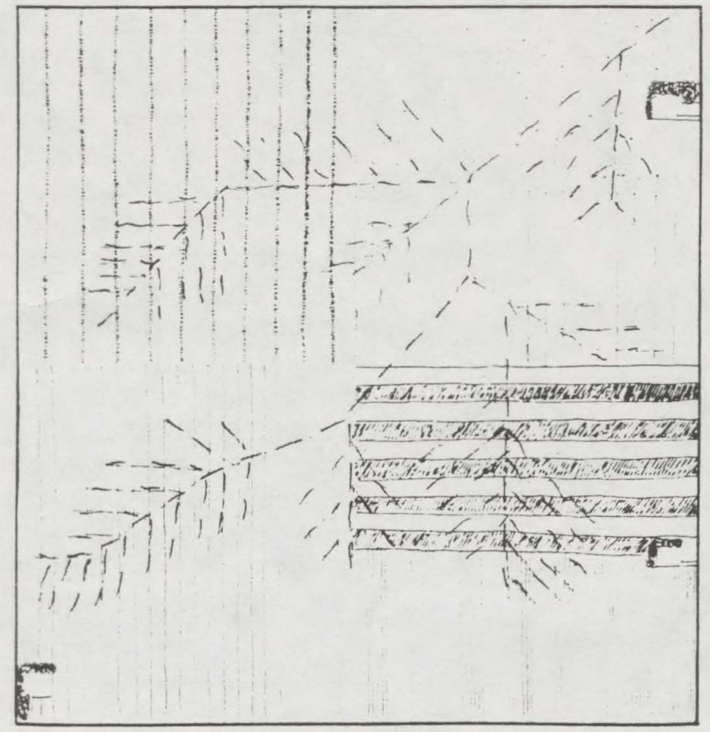
Genetically improved crop varieties, the development of chemical fertilizers and technology to enable the chemical control of crop pests, and increasing specialization among cash crop farmers produced a mid 1970's landscape whose scale rivaled that of the original prairie pot-hole complex. Field size expanded to encompass entire quarter sections and even entire half sections. Monoculture predominated as the last of the prairie pot-hole wetlands were tiled and transformed into uniform fields of corn and soybeans.



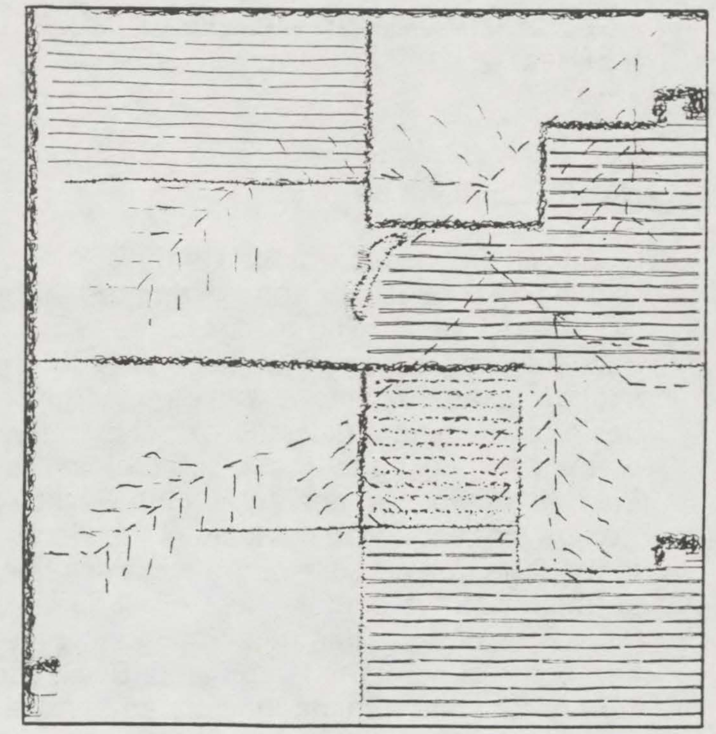
The original native landscape.
Tall grass prairie and pothole marshes dominate. The system supported an abundance of wildlife and diverse vegetation. The enduring vegetation pattern was maintained by frequent prairie fires.



An early farming landscape.
Shelter belts, windbreaks and hedgerows were commonly used. All but the largest wetlands were drained to increase crop production. The farming practices were still working in harmony with the natural environment.



Current landscape.
All windbreaks, hedgerows and wetlands are removed to maximize planting acreage. Storm water efficiently runs off the fields, but creates extreme fluctuations in the level of South Heron Lake. Surface runoff and tile drainage carries nutrients and pollutants into South Heron Lake. Natural ecosystems are extremely out of balance.



A Restored Heron Lake landscape of the future.
Windbreaks and hedgerows are returned to the landscape. Roadside plantings reduce wind erosion, decrease snow drifting on roads and increase visual interest for tourists and area residents. Conservative tillage practices are implemented to decrease soil and nutrient loss from the fields. Filter strips and retention ponds cleanse the run-off water before it reaches Heron Lake.

Transformations of the Heron Lake Landscape

RESTORING A BALANCED ECOSYSTEM

The transformation of the glaciated pot-hole prairie and wetland landscape into a large scale monoculture has improved the efficiency of crop production. The basin's farmers realize greater yields from an increased percentage of arable land.

These benefits have been obtained at a high cost to the basin's environment. Ditching and tiling of wetlands and wet prairies have eliminated the habitat of the waterfowl and shorebird populations for which the Heron Lake Basin once claimed national notoriety. Elimination of wetlands has also destroyed the basin's capacity to accommodate surface runoff from intense storms. The water level bounce now experienced by North and South Heron Lakes after storm events is partly responsible for the demise of shoreline vegetation. Ploughing the prairie has increased sedimentation in the Basin's lakes and produced a reservoir of phosphorous sitting on the bottom of these lakes. The wide scale adoption of chemical inputs in farming has produced nutrient enrichment and advanced eutrophication of area water bodies. Harmful leachates from land-applied pesticides are now found throughout the basin's hydrologic cycle and food chain.

Resolution of the basin's water quality and habitat problems depends largely on the adoption of a number of appropriate watershed management practices. These practices include:

1. Restoration of some of the basin's native wetlands;
2. Using the basin's tile and drainage network to detain and retain surface runoff in the watershed;
3. Planting vegetation filter strips next to surface water bodies (including ditches);
4. Re-establishing field windbreaks and hedgerows.

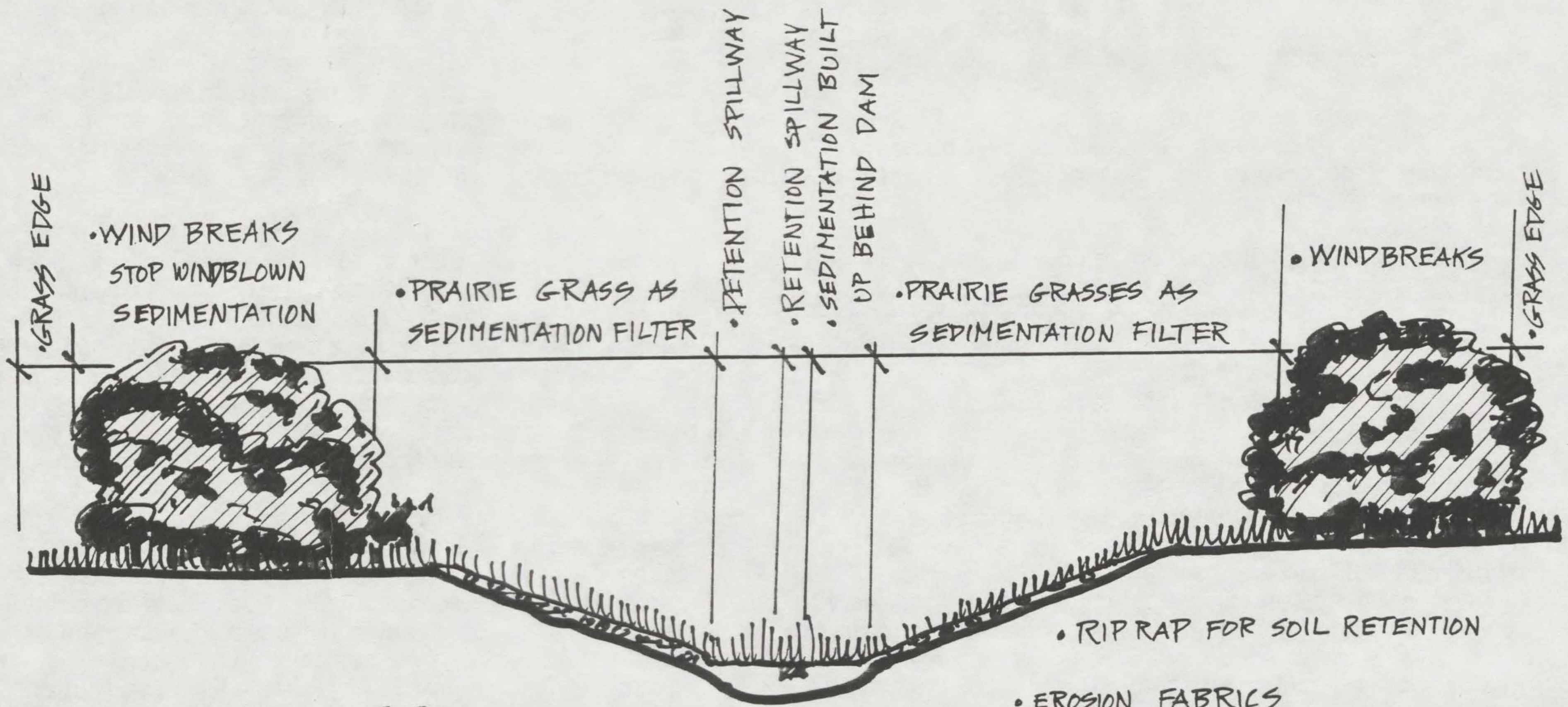
Surface runoff must be detained and retained in the watershed to prevent the transfer of soil particles and nutrients from land to water and to prevent the sudden surge of runoff into the basin's lakes. The restoration of wetlands in association with and adjacent to the basin's drainage networks of ditches and tiles presents an efficient means of slowing down and filtering the flow of surface runoff. Creation of these wetlands will address the basin water quality problems while simultaneously increasing waterfowl habitat.

The prospect of using ditches and tiles to prevent soil and nutrient flows into surface water bodies while also expanding waterfowl habitat requires a new approach to drainage management in the basin. Historically, drainage was applied to land with the objective of getting water off the land as rapidly as possible. Rather than viewing drainage as a device to de-water land, ditch managers and landowners need to view the ditches and tile systems that comprise the basin's network as a means of regulating the flow of water from land to North and South Heron Lake.

Regulating the rate of surface runoff discharge to the basin's lakes will store more runoff in catchment basins established in conjunction with the drainage ditch network. Stop-log check dams installed in the ditch systems of the upper-one-third of the basin's watershed and movable stop blocks installed in the outlets of tile systems will permit the detention and gradual release of runoff occurring after intense storms. Storm water detention will reduce the rapid fluctuation of water level on North and South Heron Lakes that currently accompanies storm events on the basin. It will also enable the settling of soil particle carried by surface runoff and reduce sedimentation in North and South Heron Lakes. Some of the catchment basins can be designed as retention basins meaning they will maintain a permanent pool. Wetlands created in conjunction with these permanent ponds will provide linear corridor systems of waterfowl habitat. Biochemical activity occurring in these aquatic ecosystems will retain nutrients in the watershed and act as runoff purification devices.

Vegetation filter strips need to be established whenever surface runoff discharges directly into surface water bodies (wetlands, ditches, streams, lakes). Strips of permanent cover crops (clover, alfalfa, etc.) need to be planted in widths ranging from between 50 and 100 feet along all sides of the water or wetland feature depending on their location in the watershed. In addition to reducing the rate of surface runoff flow, these filter strips also stop the flow of soil particles in and adjacent water body.

In addition to transforming the basin's ditch and tile systems into linear storm water detention and retention systems with associated wetlands, proper watershed management practices also need to be initiated to control wind erosion of soil. Many of the basin's landowners use soil tillage practices that leave soil covered by a crop residue that has been lightly chopped and disked into the soil surface. Residue management is effective in retaining soil particles on land in response to both wind and water erosion. It becomes even more effective when windbreaks and fencerows are established at field edges to reduce wind speeds across soils covered by residue. Establishment of woody shrub and tree vegetation in windbreaks and fencerows will also provide cover for upland game. Connection of windblock and fencerow vegetation with the vegetation of the wetlands and the detention and retention basins established to regulate surface runoff will introduce a system of linear corridors that connects upland habitat with wetland and lake habitats. These habitat corridors will promote the biological diversity that characterized the pre-settlement prairie pot-hole complex. The corridors will produce a direct increase in waterfowl habitat.



DITCH AS FILTER

Illustration of interconnecting corridors on the agrarian landscape. A ditch with a water detention system parallels the road. Drainage ditch plantings, windbreaks and hedgerows are combined to form a network of corridors, all working to improve the balance of the natural environment.

SUSTAINABLE TOURISM DEVELOPMENT

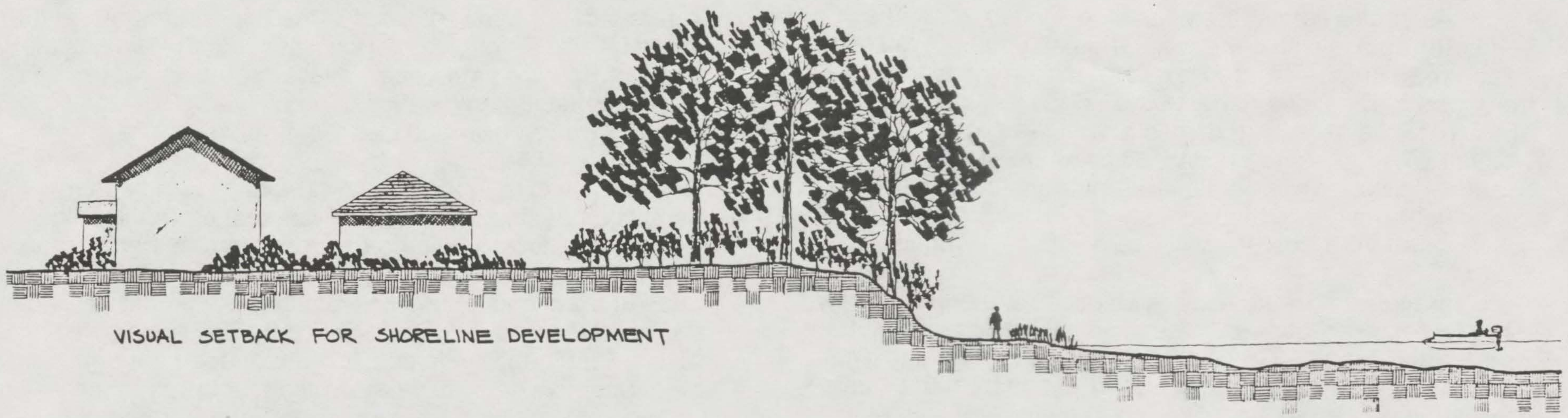
With 95% of the Heron Lake Basin landscape devoted to agriculture, it comes as no surprise that the area's primary economic base is farming. The deep, rich soils of the basin coupled with the managerial expertise of area farmers have produced high yields. Depressed commodity prices over the last few years, however, have forced farmers to seek off-farm sources of income. Community leaders, responding to the generally depressed agricultural markets, have begun to reconsider the long-term viability of farming as the community's sole economic base.

Restoration of a balanced ecosystem in the Heron Lake Basin offers an opportunity to diversify the area's economic base. With restoration of water quality in North and South Heron Lakes, and with restoration of wetland habitat in and around the two lakes, the basin will likely experience a resurgence of waterfowl and shorebird populations. Once reestablished as a haven for resident and migratory waterfowl and shorebirds, the basin will likely witness a resurgence of visitor in-flow from other parts of southwestern Minnesota and the Twin Cities. Seeking hunting opportunities and the prospect of being able to observe and photograph a landscape teeming with bird life, these visitors are a source of an economic base. Drawn by the prospect of hunting and observing the restored waterfowl and shorebird populations on the two lakes, these visitors can be induced to spend additional time and money in the basin if tourism resources are developed that will capture and retain visitor interest. Part of this resource development effort involves a careful look at the landscape.

Visitors will be drawn to the basin by the attraction of the restored waterfowl and shorebird populations. Yet the landscape possesses many additional sources of visitor attraction. During pre-settlement times, for example, Indians travelled through the Heron Lake Basin on a regular basis. Relicts from their camps abound on the east and west shores of South Heron Lake. Inkpadata, a Dakota Chieftain, occupied the so-called "Lone Tree Site" at the south end of South Heron Lake during the 1862 Dakota uprising. The trails and stopping points of Indian travel through the basin, coupled with the history of pre-settlement occupation constitute a visitor attraction waiting to be developed. Many area residents are cognizant of these sites and local Indian history. The task of developing and coordinating this knowledge remains.

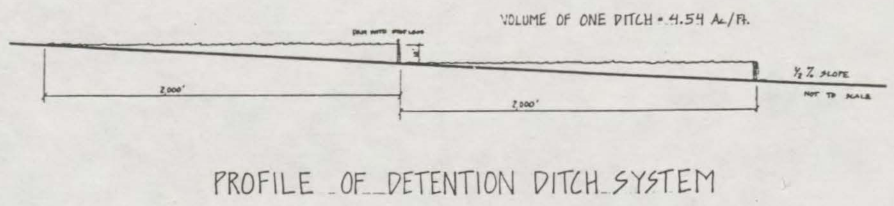
Visitor attractions from the Early Settlement period also abound in the basin. Churches built to serve early rural parishes and rural schoolhouses capture the architecture and provide glimpses of rural life in the early 20th century. Similar views into the past are provided by early residential and commercial structures in the basin's communities. The process of economic change is also etched in the changing character of rural crossroads. Rural cemeteries contain gravestones of notable early residents of the basin. The landscape of rural cemeteries as well as that along rail corridors often contain patches of relict rural prairie. A formal prairie restoration effort has been undertaken in the southeastern corner of the Heron Lake basin. Numerous area residents have photographs and can recount the lore of market hunting and the sky being filled with hundreds of thousands of birds. A self-guided coordinated and annotated tour of these historic resources would enable visitors to capture a sense of early 20th century life in the basin.

Finally, the process of restoring a balanced ecosystem will provide sources of visitor attraction. Reconceptualizing some of the basin's drainage ditches as managed linear wetlands and reintroducing tree and shrub vegetation in field windbreaks and fencerows that connect to the linear wetland system will introduce vertical elements into what is now a predominantly flat featureless plain. The addition of these elements to the basin's landscape will enhance the diversity of visual experience as visitors drive, hike, and bicycle through the landscape. The restored wetland systems and revised field patterns, in addition to improving wildlife habitat, also tell a story of a community concerned about its physical environment. These environmental restoration activities are a means by which the residents of the Heron Lake Basin can communicate their willingness to alter "business as usual" in an effort to attain "a brighter tomorrow". Restoration provides the opportunity to demonstrate good stewardship of the next generation's natural resources. The legibility of the restoration effort as a way of communicating concern for and expressing good resource stewardship is an attraction that area residents will be proud to interpret for visitors to the basin. The numerous benefits that accrue as a result of restoring the basin's ecosystem as well as the reasons for and the actual processes involved in the restoration efforts also provide opportunities for educating schoolchildren and Heron Lake Basin residents seeking to reacquaint themselves with the natural and cultural heritage of the land.



DITCH AS TOURISM

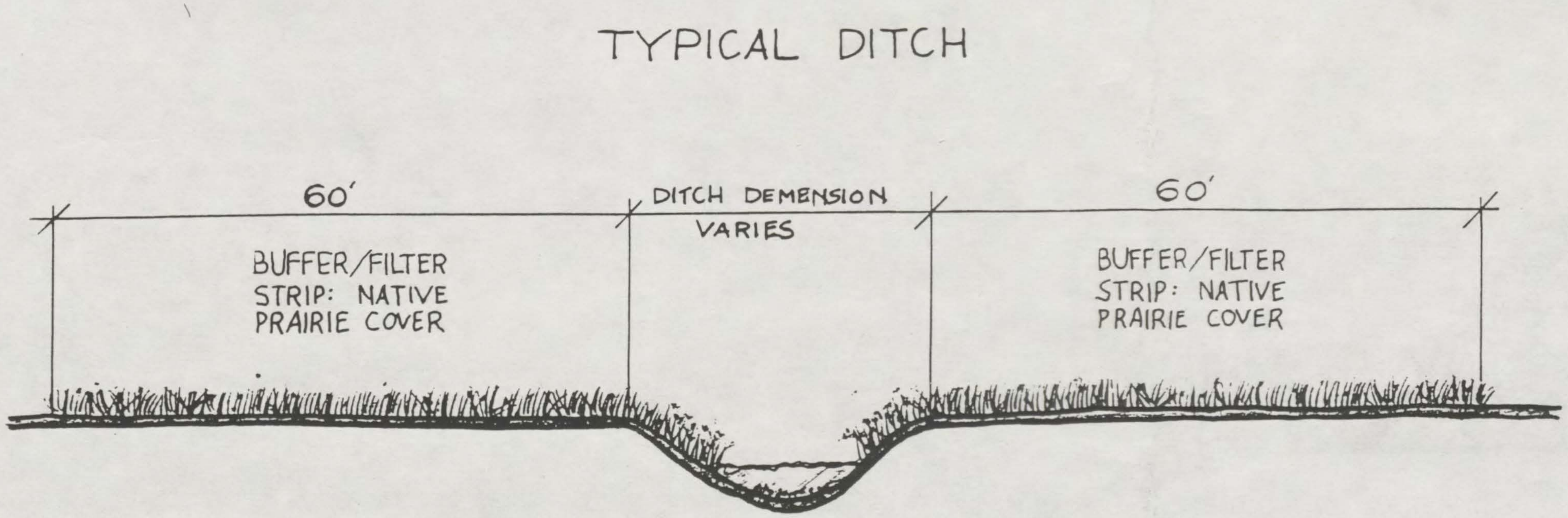
REGIONAL DESIGN COURSE PROPOSALS



Profile of a mechanical ditch detention system. The water level behind the dam is controlled by stop logs.

As stated before, the class was divided into three separate regions within the watershed of South Heron Lake. Each group independently devised a system for controlling the runoff of the fields and introducing more biological diversity to the area. Fundamentally all the solutions are working with the same principles and share similar characteristics. While the detailing of the specific designs may differ from group to group, the basics concepts are similar enough to treat the work as a collective whole.

Discussion of the classes solutions are broken down in three general categories: 1)the physical management of water, 2)the re-introduction of biological diversity, and 3)the concept of sustainable tourism. Illustrations from the classes presentation boards are utilized to graphically explain the solutions.



The existing ditches will be managed with native vegetation within the ditch and along a buffer strip between the ditch and crops. The goal is to cleanse the water before it reaches the ditches.

Water Management

One of the first steps of regaining a healthy environment is the control of water in the upper reaches of the watershed. This is a major source of contaminants in the watershed. Controlling runoff in the upper one-third of the watershed also enables more efficient control of fluctuating levels in South Heron Lake. These problems should be solved in these early stages of runoff where it is easier to slow the water down and cleanse it of pollutants.

A first step in the control of water would be the installation of stop blocks in the tiles that drain the fields. These stop blocks could be controlled by the farmer so as to not interfere with his farming schedule. By not allowing the fields to drain continuously, a substantial amount of nutrients and residues would not enter into the ditch system. Another solution pertinent to the field is the management of a continuous cover to help reduce the amount of surface run-off and soil erosion. Any reduction of runoff from the fields will have a tremendous benefit in decreasing pollutants entering the system. With the use of stop blocks in the tiles and crop residues left in the fields, farmers are able to take an active role in cleansing the watershed without interfering with their farming practices.

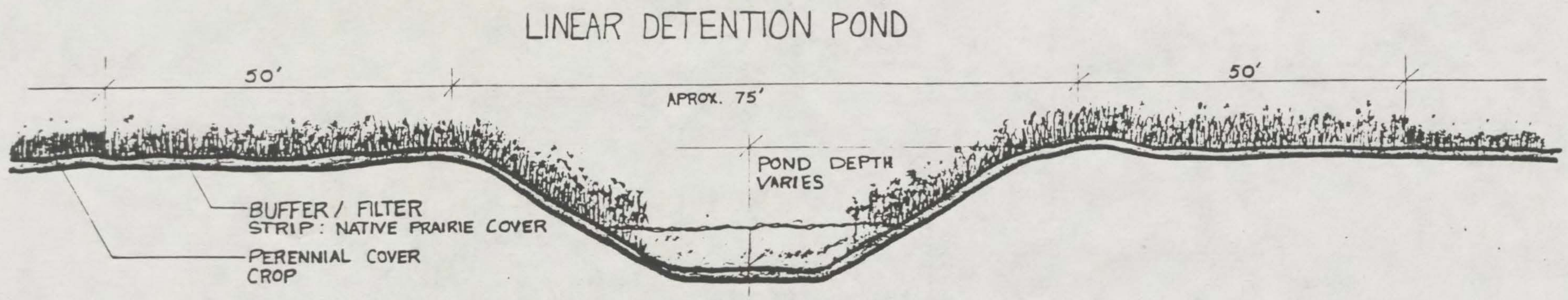
The next step in water management is the control of water in the ditches. The ditches are a ubiquitous element in the landscape, and proper management would strongly influence the watershed. The most popular solution proposed by the class is to momentarily stop the water in the drainage ditch and create detention ponds within them. This would allow the fields to drain as normal into the ditches were the water would be temporarily held for anywhere from a few hours to a few days, depending on the magnitude of the storm and the design of the detention pond. The students devised several ways to create detention ponds: using stop logs across the ditch, constructing earth berms in the ditch, or building a concrete dam.

The main objective to damming the ditches is to slow the water down before it gets to Heron Lake, and the ditches provide the most logical structure in which to trap water within the watershed. The detention dams require a minimum amount of effort to construct in relation to the benefit they have on the entire watershed. This temporary stoppage of water will allow it to percolate into the soil, helping maintain an adequate water table level. It will also help control the three to four foot bounce in the lake by decreasing the volume of water that reaches the lake and by increasing the time it takes for all the water in the watershed to reach the lake. Spreading out runoff discharge in the watershed will soften the effects of the surge after a big storm.

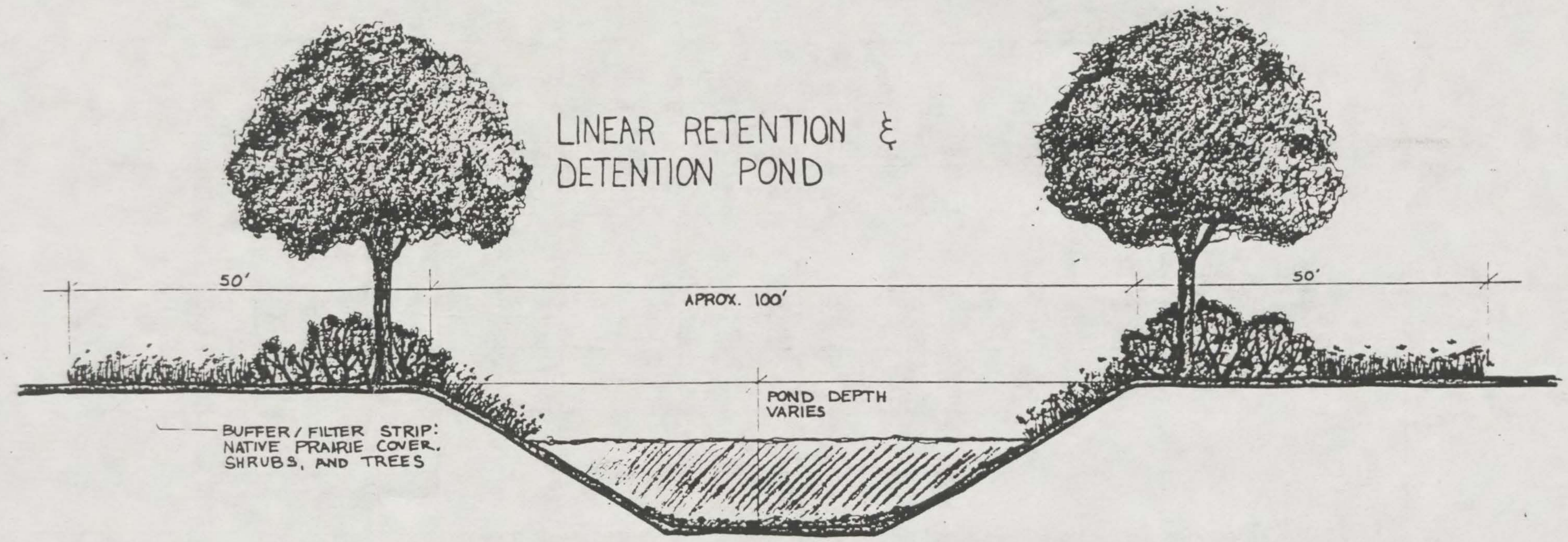
Another popular proposal for the management of runoff is the creation of retention ponds that are incorporated into the landscape. These are permanent bodies of water that, like the detention ponds, will act as a stabilizing influence in the rate and duration of the water flow to the lake. The retention ponds have an advantage over the detention ponds in that they are larger and generally have a greater capacity to hold storm water. The permanent ponds will be able to cleanse the water of suspended particles better than the detention ponds due to the longer length of time the water will take to pass through them. The retention ponds will also help remove soluble contaminants in the runoff due to the biochemical activity of animals and plants living in and around the ponds.

The greatest drawback to the retention pond is that the areas flat topography means that the ponds must be quite large in order to hold a decent volume of runoff. This will encroach on the land that could otherwise be farmed. A compensation system would have to developed for the farmers where the retention ponds encroachment significantly reduces production levels.

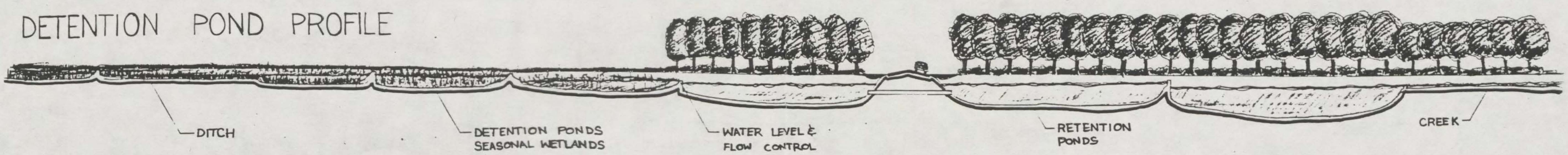
Management of the detention/retention pond systems is conceived to be under the control of a public agency that combines hydraulic, wildlife and recreation resources. The agency could be similar to the Judicial Drainage District and run entirely on a regional or county level, specifically addressing the needs and concerns of the farmers. This public agency will be locally stationed and could be funded by the counties within the watershed.



Cross-section of a detention pond made from a ditch. Standing water only occurs after a heavy rain. All native vegetation is used to filter run-off water.



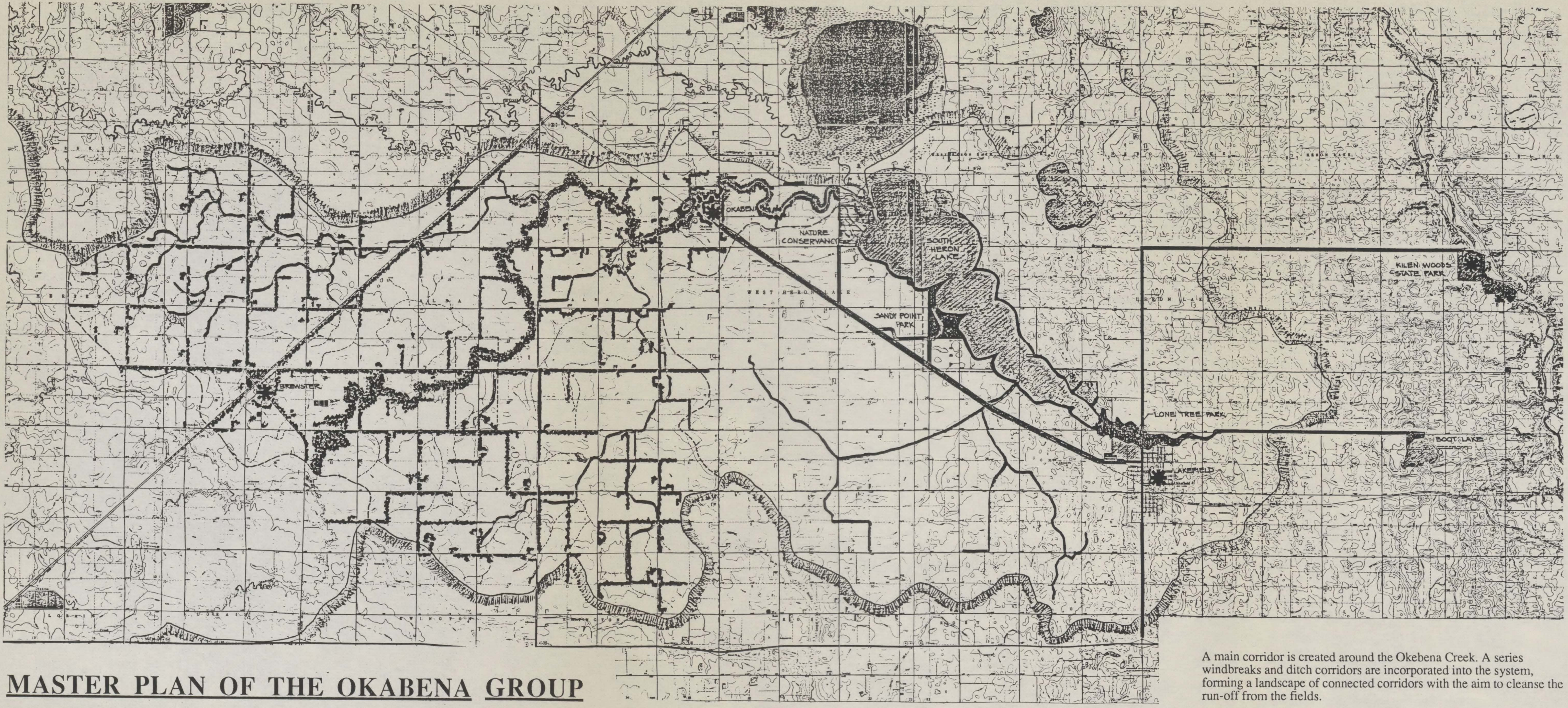
Retention pond incorporated in the drainage system. Permanent standing water and dense native plantings help filter contaminants out of the storm runoff water.



Profile of a system of ditches, wetlands and ponds designed to filter excessive residues and nutrients from run-off water. The existing creeks are left in their natural state.

The run-off water passes through a series of detention ditches, retention ponds and natural creek beds in an effort to cleanse the water before it reaches the lake. Windbreaks and prairie plantings on the roads further help to reduce wind erosion and introduce diverse wildlife habitat back into the agricultural landscape.

WATER MANAGEMENT PLAN OF THE ELK CREEK GROUP



MASTER PLAN OF THE OKABENA GROUP

A main corridor is created around the Okebena Creek. A series windbreaks and ditch corridors are incorporated into the system, forming a landscape of connected corridors with the aim to cleanse the run-off from the fields.

Biological Diversity

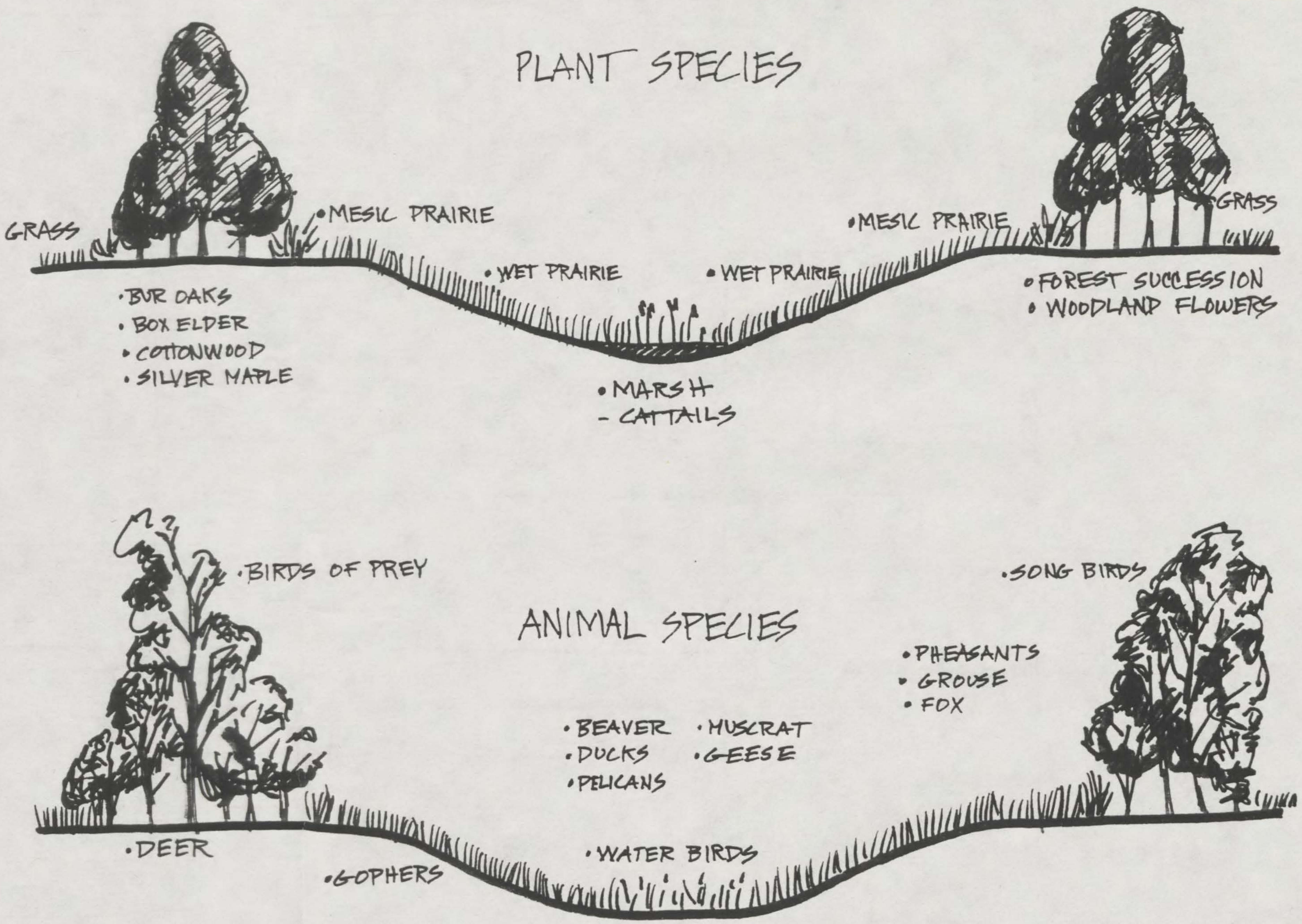
Incorporated with the detention ponds in the ditches will be vegetative planting on the banks and bottoms of the ditches. The vegetation will help the environment in two ways:

1) Help slow the water down, thus filtering out the silt and reducing the impact of the bounce;
2) Absorbing the nutrients in the run-off, thus helping reduce the amount of pollutants that reach the lake.

The corridor planting will strive for a wide range of species to help absorb as many nutrients as possible. An idealized cross section would be; farmland, grass strip, shrubs, trees, shrubs, grasses in the ditch and then trees and shrub on the other side. This dense planting will provide great diversity of plants and animals while also serving as a water control. The trees at the retention ponds will help shade the water, which will keep it cool and prevent algae build up. The plantings along the ditches will also help keep the soil moist, permitting soil moisture to percolate into the water table instead of evaporating.

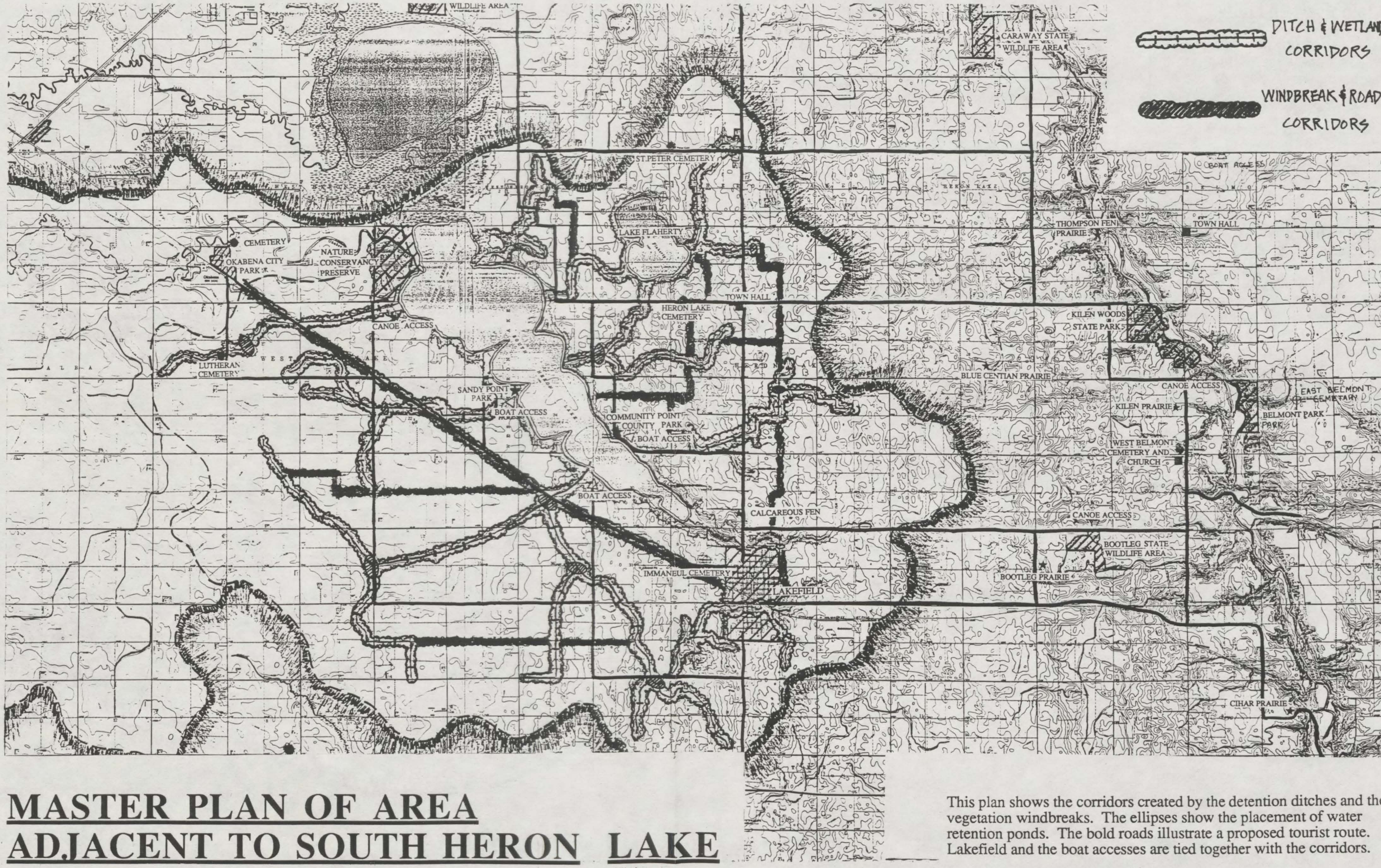
Trees and shrubs should also be incorporated in the windbreaks on the open farmland. Wind erosion depletes the soil resource and it results in soil particles being blown into surface water bodies. Therefore, windbreaks need to be incorporated into the vegetation pattern of every field. Native species should be used in the windbreaks to help increase the natural biological diversity of the landscape. The windbreaks will have a four major functions: 1) by breaking the wind, they reduce erosion, and 2) they act as snow-catches, which allows moisture to be retained in the fields. 3) They provide wildlife habitat corridors; and 4) they add visual diversity and a scenic element to the landscape.

perceived as being scenic, and they would provide a record of what the land looked like before white settlement.



DITCH AS HABITAT

GOALS – STABILITY & DIVERSITY



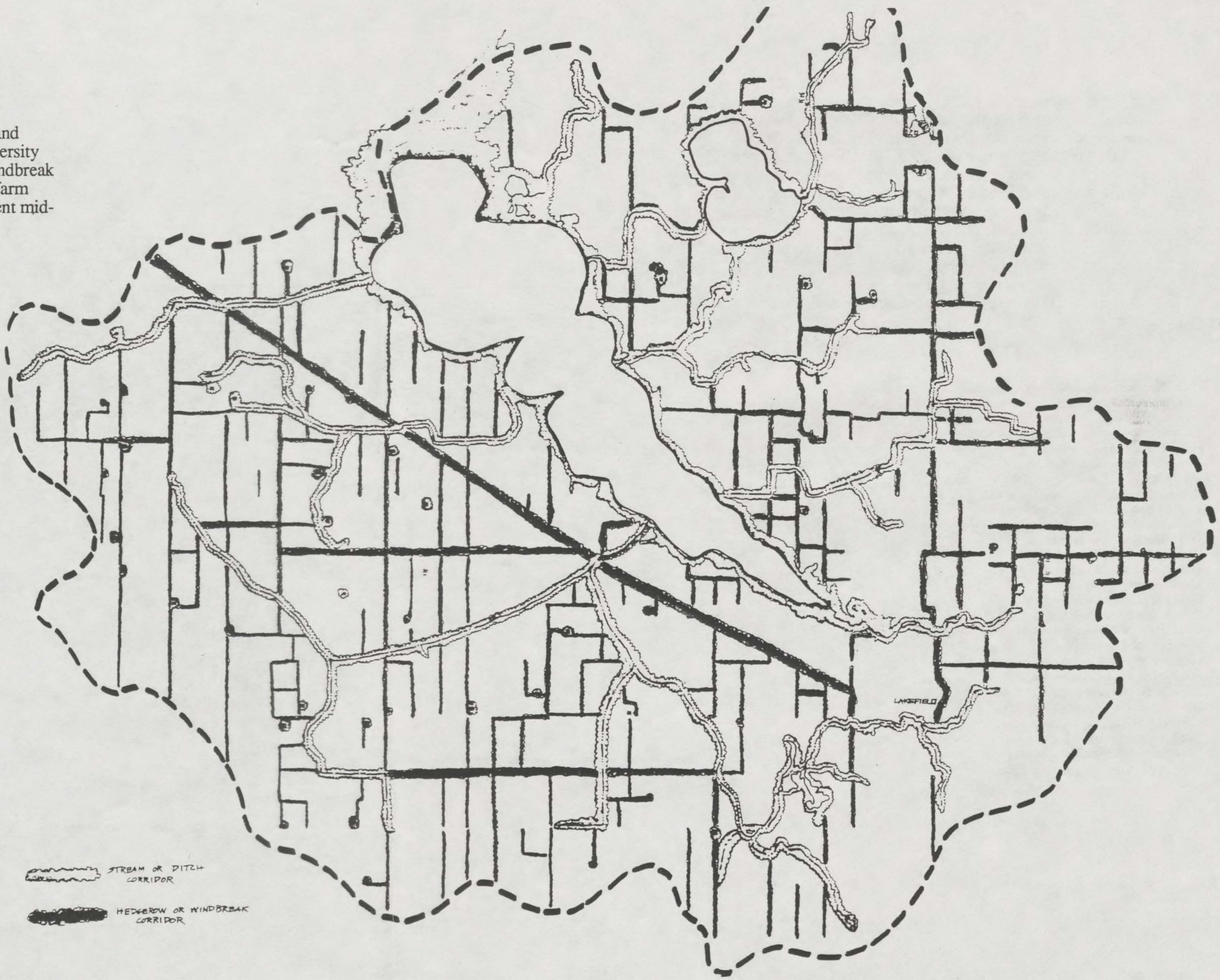
MASTER PLAN OF AREA ADJACENT TO SOUTH HERON LAKE

This plan shows the corridors created by the detention ditches and the vegetation windbreaks. The ellipses show the placement of water retention ponds. The bold roads illustrate a proposed tourist route. Lakefield and the boat accesses are tied together with the corridors.

CORRIDORS

South Heron Lake Watershed

The drainage corridor is created by planting along the ditches and streams in order to cleanse the run-off and bring biological diversity into the environment. Linking these drainage corridors are windbreak and roadside plantings. The windbreaks are placed along the farm boundaries. Hedgerow plantings are encouraged to help prevent mid-field soil erosion.



In the development of the native and natural systems it is very important that the right plants are used. Many seed sources that claim to be "wild flowers" are not native to Minnesota and may contain seed of unwanted noxious weeds. The best seed source is through a Minnesota based company that grows its own stock or can guarantee the origin of the seeds. At present the production of native seeds has not reached the scale of non-native commonly used plants so the cost of the native seeds is quite a bit more. As seductive as the "wild flowers in a can" are, they are not a viable source for restoring the landscape to its original productive state.

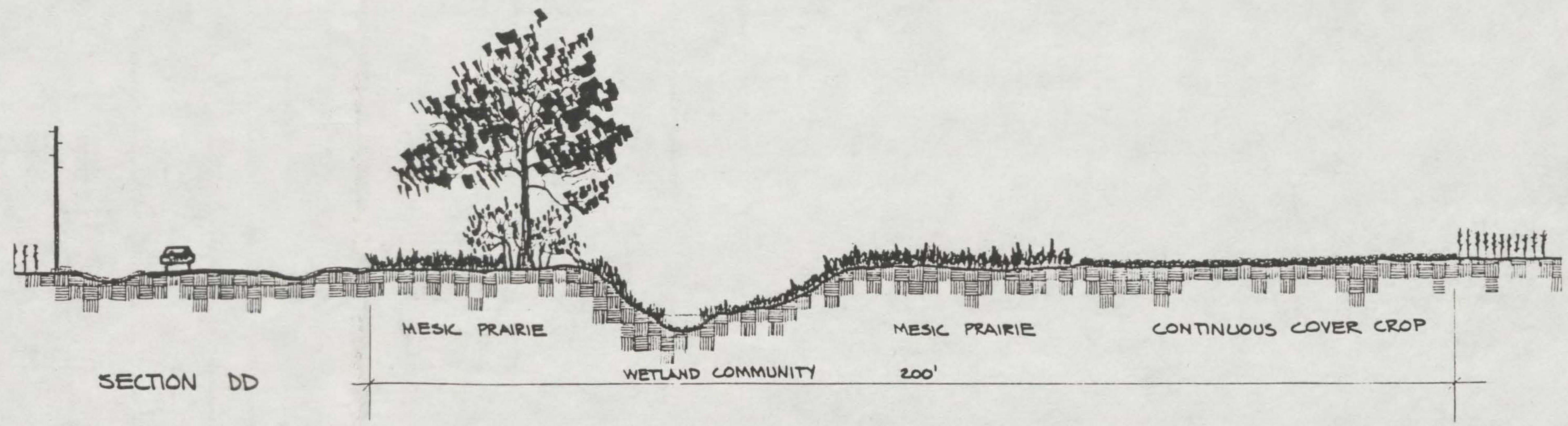
Some of the native species that should be considered when planting are:

Wet Prairies

Blue Bluestem *Andorpogon gerardi*
Canada Anemone *Anemone canadensis*
Swamp Milkweed *Asclepias incarnata*
Common Milkweed *Asclepias syriaca*
New England Aster *Aster novae-angliae*
Bluejoint Grass *Calamagrostis canadensis*
Midland Shootingstar *Dodecatheon meadia*
Queen of-the Prairie *Filipendula virginiana*
Bottle Gentian *Gentiana andrewsii*
Sawtooth Sunflower *Helianthus grosseserratus*
Wild Blueflag *Iris shrevei*
Blueflag Iris *I. versicolor*
Prairie Blazingstar *Liatris pynostachya*
Spike Blazing *L. spicata*
Wild Bergamot *Monarda fistulosa*
Prairie Sundrops *Oenothera pilosella*
Downy Phlox *Phlox pilosa*
Common Mountain Mint *Pycnathemem virginiana*
Grayheaded Coneflower *Ratibida pinnata*
Black-eyed Susan *Rudbeckia hirta*
Riddells Goldenrod *Solidago riddiellii*
Stiff Goldenrod *Solidago rigida*
Prairie Cordgrass *Spartina pectinata*
Tall Meadow Rue *Thalictrum dasycarpum*
Ironweed *Vernonia fasciculata*
Culversroot *Veronicastrum virginicum*

WINDBREAK

A windbreak that can be incorporated in the field to cut down on soil erosion and to add biological diversity to the landscape.

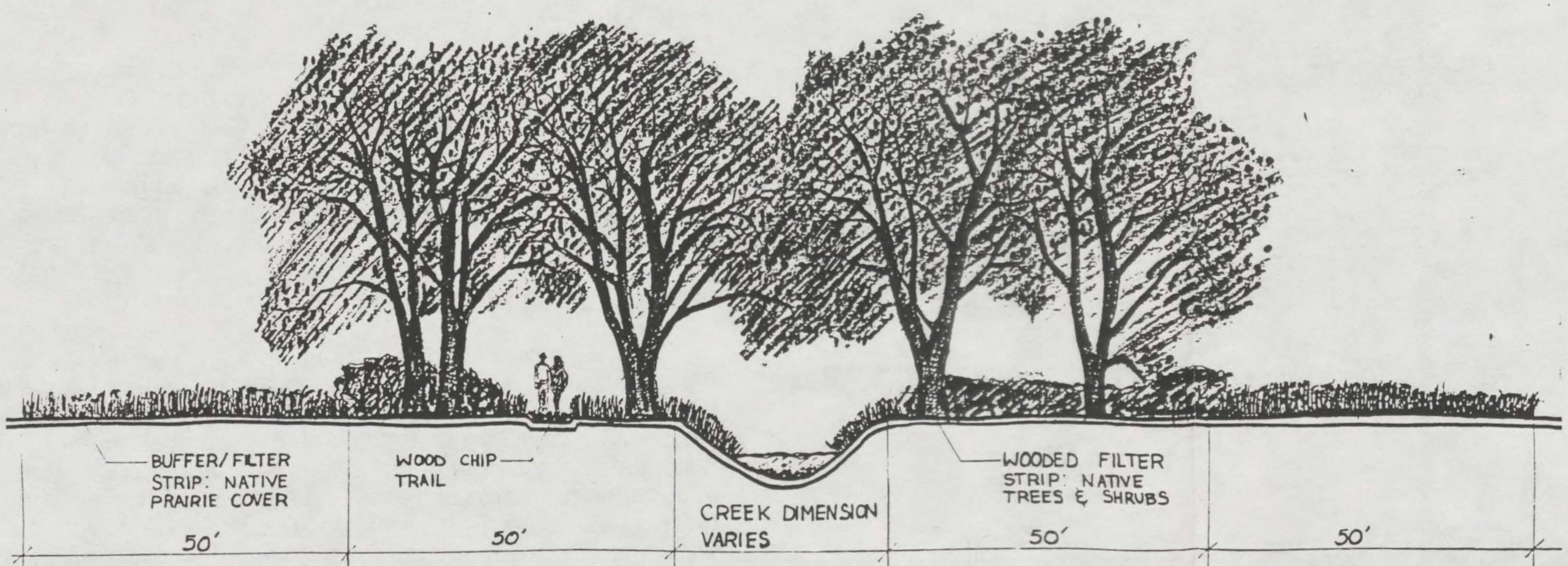


Profile of the relationship of the farmland to the designed native plant communities along the ditches.

HEDGE WINDBREAK

Hedgerow - working on the same principle of the windbreak but requiring less space.

CREEK SECTION



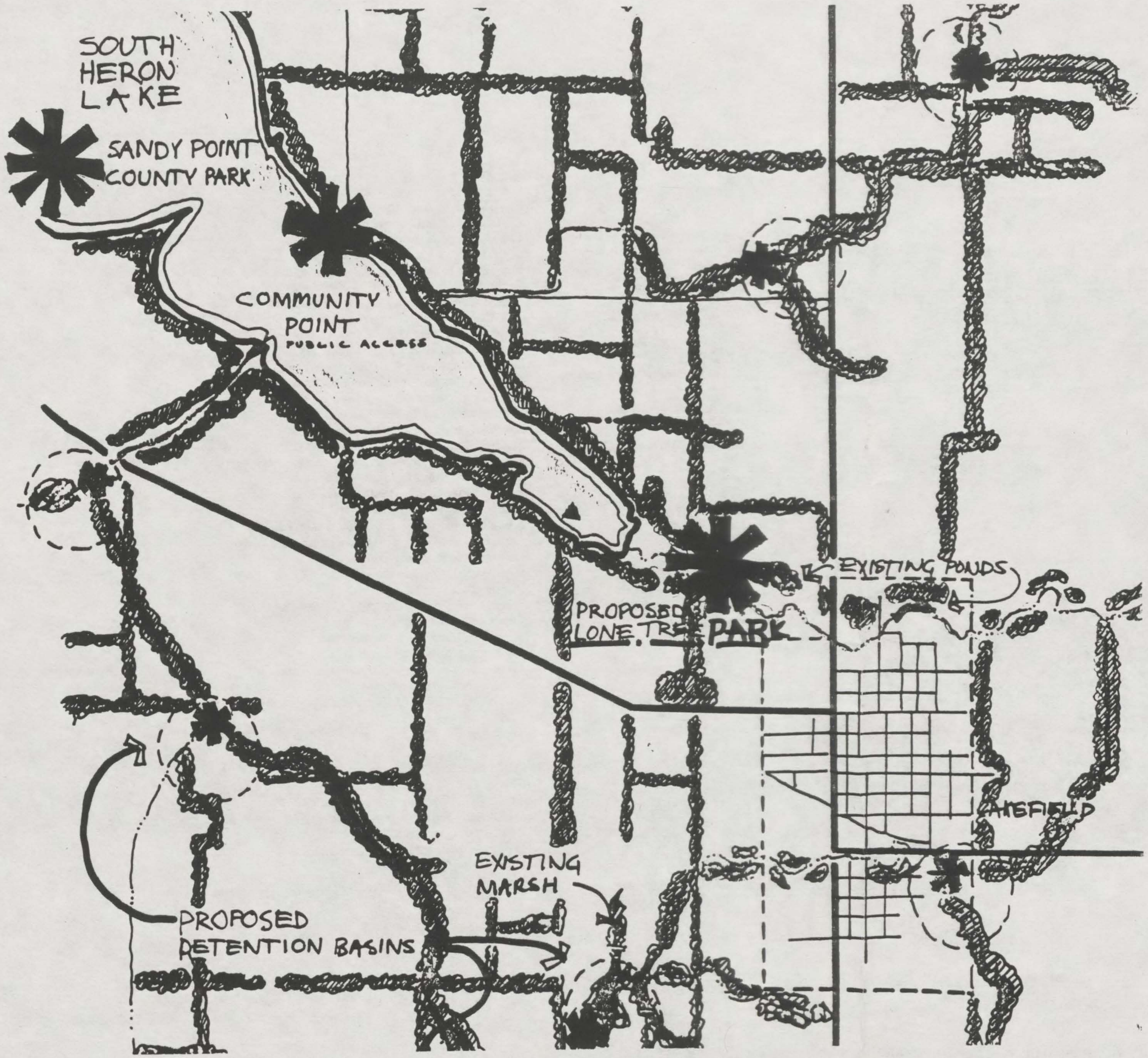
Cross section of an existing creek managed to increase biological diversity along the banks. The native plantings also help cleanse the water.

Mesic Prairies

Leadplant *Amorpha canescens*
Big Bluestem *Andropogon gerardi*
Little Bluestem *A. scoparius*
Thimbleweed *Anemone cylindrica*
Butterflyweed *Asclepias tuberosa*
New England Aster *Aster novae-angliae*
White False Indigo *Baptisia leucantha*
Prairie Coreopsis *Coreopsis palmata*
Tall Coreopsis *C. tripteris*
Purple Coneflower *Echinacea purpurea*
Canada Wildrye *Elymus canadensis*
Prairie Smoke *Geum triflorum*
Sawtooth Sunflower *Helianthus grossesserratus*
Rigid Sunflowere *H. laetiflorus*
Maximilan's Sunflower *H. maximiliani*
Rough Bazingstar *Liatris aspera*
Prairie Blazingstar *L. pycnostachya*
Hoary Puccoon *Lithospermum cansescens*
Wild Bergamont *Monarda fistulosa*
Prairie Panic Grass *Panicum leibergii*
Switchgrass *P. virgatum*
Smooth Penstemon *Penstemon digitalis*
Purple Prairie Clover *Petalostemum candidum*
Downy Phlox *Phlox pilosa*
Grayheaded Coneflower *Ratibida columnifera*
Prairie Rose *Rosa spp.*
Black-eyed Susan *Rudbeckia hirta*
Stiff Goldenrod *Solidago rigida*
Showy Goldenrod *S. speciosa*
Indiangrass *Sorghastrum nutans*
Prairie Dropseed *Sporobolus heterolepis*
Needlegrass *Stipa spartea*
Tall Meadow Rue *Thalictrum dasycarpum*

Trees and Shrubs

Cottonwood *Populus grandidentata*
Silver Maple *Acer sacharinum*
Green Ash *Fraxinus pennsylvanica*
White Ash *Fraxinus americana*
Red Cedar *Juniperus virginiana*
Willow *Salix spp.*
Dogwoods *Cornus sp.*



Tourism in the Agricultural Prairie Pot-Hole Complex

The planting along the ditches, the windbreaks and the roadside planting will be tied together in a system of corridors. This forms a network of ponds, creeks, restored wetlands and native planting that link together in a way that could be very important in cleaning up the watershed and increasing biological diversity. The system that the class recommends establishes a mechanism for holding energy, nutrients, soil and water in the upper potion of the watershed where it should remain to create a healthy ecosystem. This network also provides for plant and animal species movement throughout the watershed in a diverse array of interconnected habitats. This "first step" in improving the watershed is essential if plans for education and recreation in the are are to succeed.

If the program is successful, watershed management and restoration could become a point of interest to visitors to the area. An educational approach for visitors to the area would bring groups from educational institutes of all types, from elementary schools to large universities. This approach might also attract bird watchers and other related groups from various regions of the state. Education and recreation could work together for a contemplative approach to visitor attraction-- the education theme becomes a large part of the recreation with the waterfowl serving as the basis of this attraction.

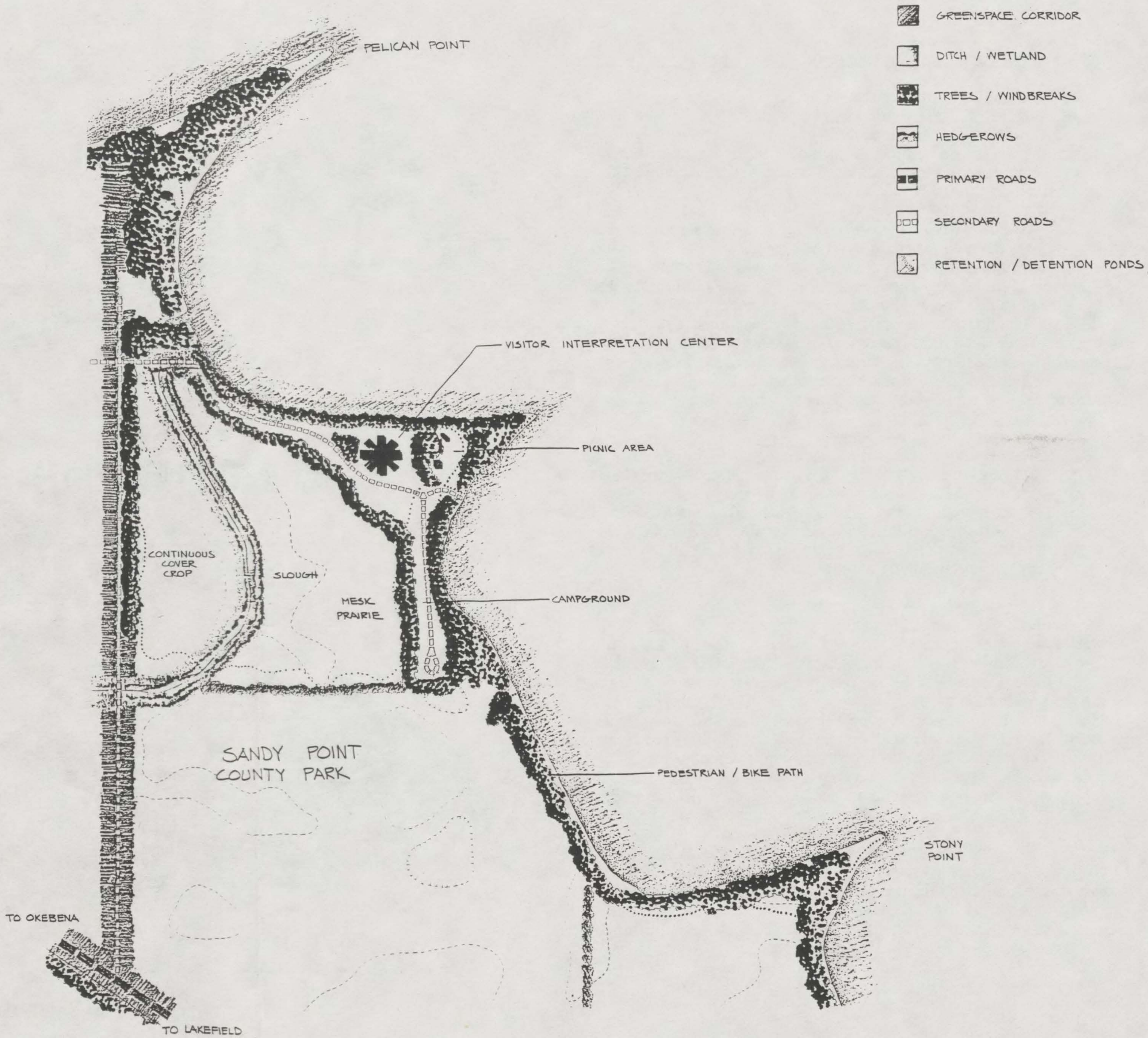
Scenic drives and recreational activities should link the western portion of the watershed with the area immediately adjacent to South Heron Lake. Within this area, extensive restoration of former wetlands will provide habitat for many waterfowl species. Bike access and primitive campgrounds should be provided for passive recreation activities. Views of detention/retention areas not only provide recreational objectives, but also demonstrate how restoration and farming can work cooperatively with nature.

The Heron Lake basin contains many cultural and natural attractions. A farm museum is proposed for Okebena. Lakefield contains the Glass House and the Jackson County Historical Center. An expansion of the historical center into a historical and regional center might provide helpful information to interpret the cultural and natural heritage and diversity of the area. A scenic drive could wind through the watershed, connecting churches, cemeteries, old town halls and Kilen Woods Sate Park. Within the middle watershed, restored wetlands can serve as an attraction, connected by scenic drives and pedestrian paths.

In a regional design with future tourism in mind, Heron Lake will have biking and hiking trails beginning at the Nature Conservancy preserve on the western shore of South Heron Lake, passing through Sandy Point Park and a Lone Tree Park to be created at the south end of the Lake and ending at Community Point. A portion of the trail will divert into Lakefield for touring the parks and business district. Overnight lodging and rental cabins could be incorporated into the south eastern side of Heron Lake. These accommodations would be used by research groups, educational classes, hunters and general visitors to the area, and also provide a new source of commerce to the area.

Public access to the site is an important element that needs to worked out in the designing and planning stage. Public easements should be stated in the initial proposal so there are connections through the corridors for the public. At the same time, public access must infringe on neither the farming operation nor, the privacy of the farm homesteads. Corridor managers will need unlimited access to maintain the system.

All of the possibilities for visitor attraction to the Heron Lake watershed are contingent upon water quality. Without improved watershed management, water quality and waterfowl habitat will never be restored to the area.



A Trip Through the South Heron Lake Landscape in 2010

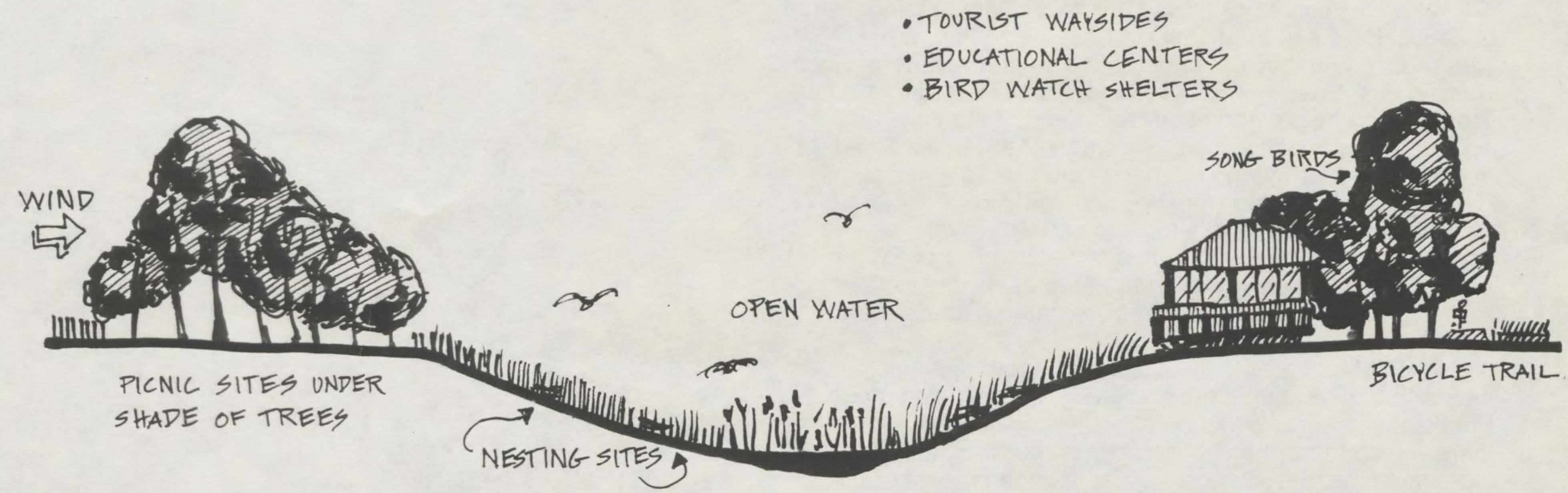
If the design proposals suggested by the class were implemented at this time, within twenty years the landscape would be noticeably different. The land would not only look physically different but it would be functioning quite differently. Nutrient flows would be restored to a more balanced state, and waterfowl would once again abound in the area.

The most striking feature of the future South Heron Lake landscape is the copious amount of trees and shrubs that form wide and narrow corridors and seem to crisscross and intersect everywhere. The view to infinity has been replaced with lines of trees that pull the eye into the landscape and create interesting patterns as one passes through the land. The corridors appear as dense masses of trees, forming walls that create spaces and enclosures in the fields and around the homesteads. The frequent visitor notices the changing colors of the corridors; flowers in the spring, different greens in the summer, fall colors, and different branching patterns and textures in the winter.

A closer observation reveals an increase of wildlife. Flocks of birds can now be seen and heard flying over head. Mammals are more prevalent and the fishing is now really good in South Heron Lake. As one approaches the lake, bicyclists and hikers passing through wooded corridors become a familiar site. The visitors are enjoying themselves within and adjacent to several corridors, viewing the countryside and watching wildlife.

The word has gotten out that the fishing is good, for there are scores of people fishing at South Heron Lake. The restored waterfowl population has also brought an increase in sport hunters. The calm morning silence being broken by gunshots in the North Heron Lake region. Yet the most novel hunter increase in the region are the people seen tramping through the marsh with cameras, field glasses and guide books. Heron Lake has now become a national mecca for naturalists searching out the teeming wildlife. The National Audubon Society is now planning yearly trips to the area for its members. Colleges around the nation are using the area as a source for waterfowl restoration, sending students into the field to collect data and study a balanced ecosystem within productive farmland.

Motels and cabins have developed around the lake to accommodate the visitors. A new commerce has developed that caters to both the hunter and the hiker. Downtown Lakefield now looks like a very active small town, capable of attracting visitors solely on its quality of restaurants and shops. The area is hardly recognizable to the person who has been gone for twenty years.

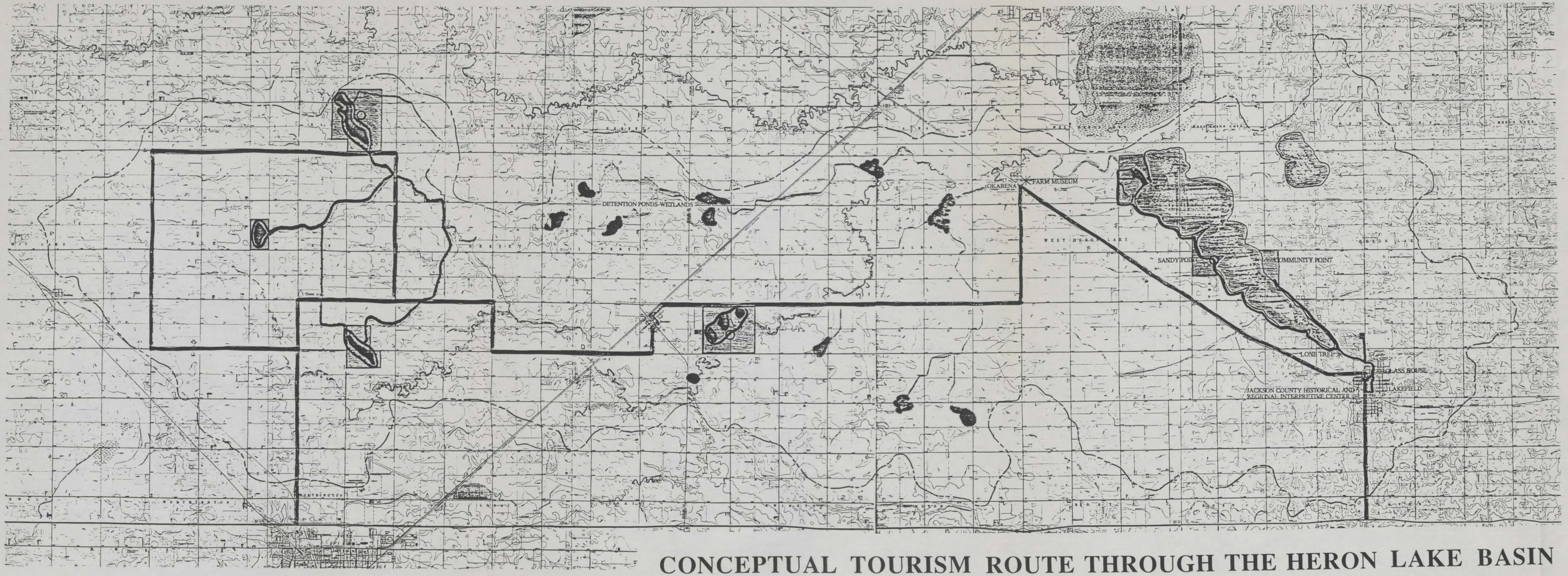


DITCH AS RECREATION:

• TRAILS ALONG DITCHES PROVIDE ACCESS TO WILDLIFE
• SHELTERS PROVIDE UNOBSTRUCTED VIEWS

photo by Robert Friedman

photo by Rhett J. Arens



CONCEPTUAL TOURISM ROUTE THROUGH THE HERON LAKE BASIN

CONCLUSION

The glaciated prairie pot-hole complex of the South Heron Lake Basin was once a haven for teeming populations of waterfowl and shorebirds. The introduction and development of white settlement in the area has paralleled the degradation of water quality in the basin and the decline of bird populations. Much of this environmental destruction can be traced to the way land in the watershed of South Heron Lake is used and managed.

For the last 90 years, the major objective of the watershed management in the basin has focused on moving water over and through soil as rapidly as possible. These practices have lead to heightened rates of sedimentation in South Heron Lake, movement of excessive levels of nitrogen and phosphorous into the lake, reduction of the lake's water quality, decline of aquatic habitat, and elimination of waterfowl and shorebird habitat. Reversing these trends requires the adoption of watershed management strategies that slow the rate of water movement, retain more surface and subsurface flows on the land, and promote the reestablishment of the biological diversity that characterized the pre-settlement prairie pot-hole landscape.

Restoring South Heron Lake requires a new vision for managing water and wetlands in the Basin. The tile and ditch systems developed to de-water the land must be viewed as technologies for detaining and retaining water as well as a means of promoting water flow. Wetlands must be viewed not just as potential cropland that is too wet to farm, but as areas that absorb and purify the surface water flows. These are the areas that currently produce vast fluctuations of South Heron Lake levels after rainstorms. Wetlands must also be seen as areas that provide important wildlife habitat. They are important parts of the watershed that need to be as carefully nurtured and preserved as does the rich agricultural land. The tile and ditch drainage system must be viewed as a technology through which the hydrologic and wildlife values associated with wetlands can be achieved.

When residents of the watersheds develop a shared "revisioning" of water, wetlands and drainage in the South Heron Lake Basin, the Lake's water quality will be restored and the basin will once again reclaim its position as "the Chesapeake Bay of the North". The restorative properties of natural systems are strong, but they need a clear and careful refocusing on the role of wetlands and land drainage in a balanced ecosystem for the basin.

Restoration of the basin's teeming bird populations will accompany water quality and habitat restoration. The basin will once again possess a tremendous source of natural attraction to which visitors will flock from throughout Minnesota and the Upper Midwest. With them, these visitors will bring the benefits of a new economic base for the region in ecologically-based and ecologically sustainable tourism. The alternatives seem quite clear, the choice depends upon the residents' ability to forge a consensus public policy that provides just compensation for property damage loss and enables the basin's restoration to be realized.

photo by Bill Marchel

Stall Norwegian Lutheran Church
(From "History of Jackson County, Vol. II)